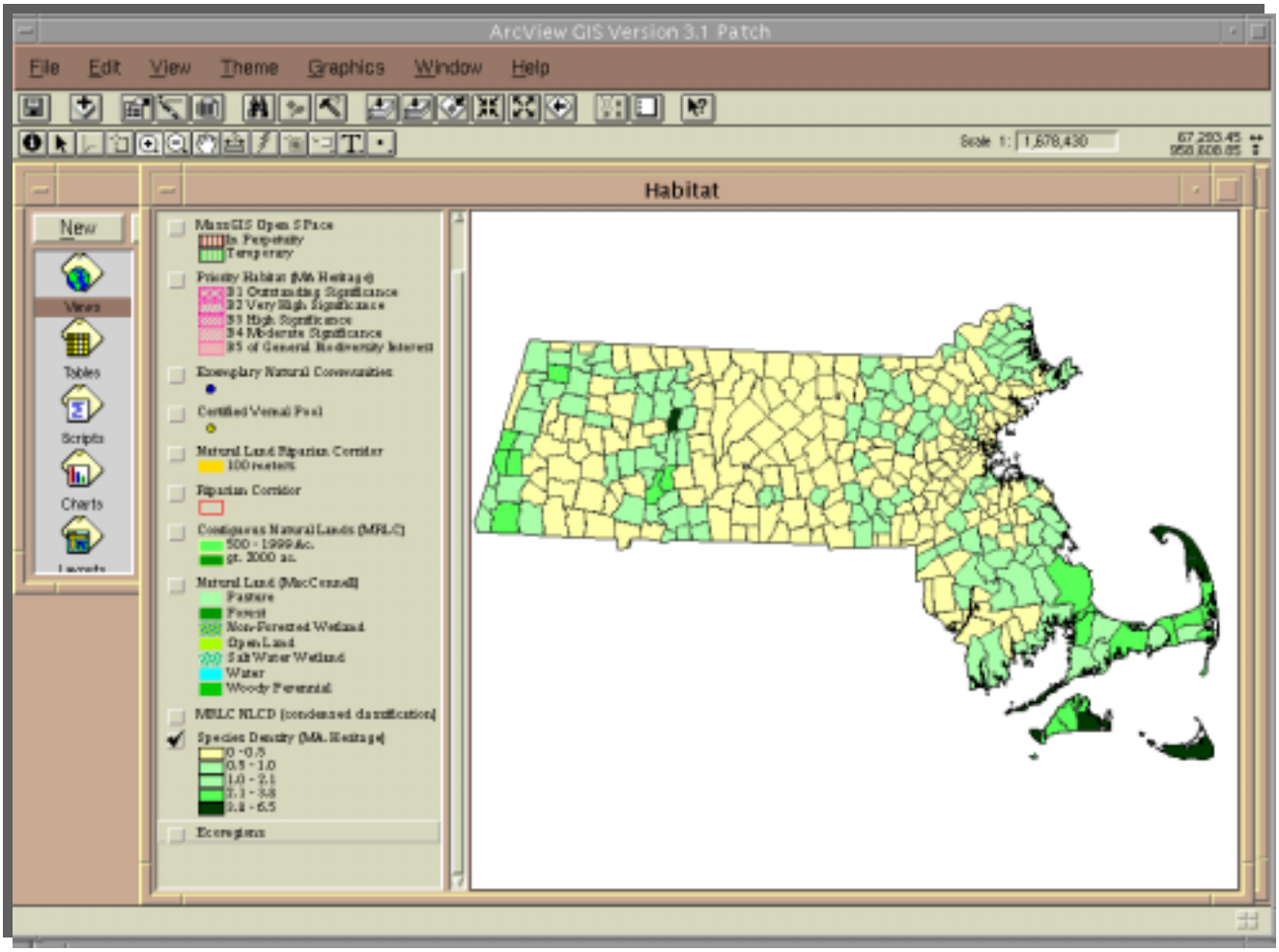
The Massachusetts Resource Identification Project

Project Report

September 1998 –December 1999



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I. Executive Summary

The Massachusetts office of Geographic Information System (MassGIS) and the U.S. Environmental Protection Agency (EPA) initiated the Massachusetts Resource Identification Project (MRIP) in October 1998. MRIP is a component of the EPA Resource Protection Project, a regional effort to focus attention on important natural resources within the New England states.

The identification of natural resource areas important to the quality of life and promotion of an ecosystem approach to natural resource management was the focus of the project. In line with the Executive Office of Environmental Affairs (EOEA) overall policy goals, the project promoted recognition of the critical relationship between ecosystem health and human health, acknowledging that it costs much less to protect natural resources than it does to clean up degraded areas.

The project design emphasized the development of a "decision support system tool" for articulation of features and phenomena related to natural resources important to the quality of life. Previously completed projects (CT, ME, NH, RI) emphasized facilitating protection of natural resources within identified "focus areas" by working with all appropriate parties. MRIP efforts, including the development of the MRIP tool and map products, were tailored to assist planners, resource specialists, and EOEA Watershed teams with the systematic identification of distribution and abundance of natural resources, as well as protection of important natural resources statewide. Provision of information assisting planning efforts at regional (state), landscape (watershed), and community scales summarizes the intended use of the MRIP products.

Coordination with appropriate parties, including guidance from the MRIP Steering Committee, provided the requisite input for the tool design. Specifically, input received from over 75 scientists, planners, and resource specialists representing 18 federal, state, and municipal organizations directed the selection and effective display of specific resources contained within the MRIP tool. The MRIP decision support system tool was integrated into the MassGIS Data Viewer, a GIS software program. The MassGIS Data Viewer, including the MRIP component, is distributed upon request to various members of the planning community: EOEA staff, municipal officials, educators, non-profit organizations, watershed teams, and others.

In addition to the development of a planning tool, the MRIP effort included a component identifying and delineating resource concentration areas within Massachusetts. The MRIP Steering Committee assisted this effort by providing input defining specific resources for which the identification of co-occurrence was of interest. Similar to information contained within the MRIP tool, the resource concentration area information can serve to assist resource protection efforts, particularly efforts targeting resource protection partnerships.

II. Background

In 1993 the EPA began an initiative - The Resource Protection Project - to help target the most important natural resources in New England and to promote an ecosystem approach to resource management. Protection of healthy ecosystems, rather than restoration of impaired ecosystems was the primary focus of the effort.

The scope of the Resource Protection Project -- the six New England states -- was determined to be too large and complex to approach all at once. Although the ecosystems and watersheds of the region do not necessarily follow the states' boundaries, the organization of such a large project required a state-by-state focus. The pilot project, New Hampshire, was completed in 1994. Rhode Island ('96), Connecticut ('97), and ME ('99) followed. Project completion refers to Phase One efforts; additional efforts have been completed, are underway, or will soon be initiated, varying amongst states. Phase Two examples include the provision of additional funding to support resource protection initiatives within designated focus areas, the establishment of partnerships to protect the identified high priority resources, refinement and addition as well as distribution of GIS data connected to the projects.

The Massachusetts component - The Massachusetts Resource Identification Project (MRIP) - was initiated during the fall of 1998. MassGIS, a division within EOEA, received EPA funding to coordinate the MRIP project.

III. MRIP Design

In summary, the project proceeded as follows: a project coordinator position was created, project steering committee assembled, and a project scope drafted, including focus, goals, timeline, product development, and outreach components. The project coordinator initiated efforts during September 1998. Interaction with resource professionals, steering committee meetings, and product development were completed by October 1999. Product integration was accomplished in the spring of 2000 and distribution was targeted to occur by June 2000.

Section III provides a description of the project design, including the project focus and goals, as well as the role of the steering committee and project coordinator. Section IV provides a detailed description of products developed, including the MRIP tool, Resource Concentration Areas data layer, and map products. In addition, Section IV lists data prioritized for future updates. Acknowledgments are contained within Section V and Section VI provides the report conclusion.

A. Project Design

As the pilot project, it was envisioned that the project design developed for the New Hampshire Resource Protection Project would be duplicated within the other New England states; the New England State projects would prioritize the identification of focus areas and support additional protection efforts within these areas. However, each state modified the project to reflect the unique geography of its landscape as well as existing political conditions.

In Massachusetts there are numerous planning activities allocating resources towards the protection of natural resources, many of which work to identify specific geographic areas or "focus areas" within which to concentrate efforts. Examples include: Areas of Critical Environmental Concern (ACEC), Department of Fish and Wildlife (DFWELE-DFW) focus area designations; EOEA Basin Team designated biodiversity/historic/scenic/cultural/etc., focus areas; focus areas defined by non-profit groups such as The Nature Conservancy, The Trustees of Reservation and regional land trusts; and prioritized protection areas identified within municipal open space plans.

Resource or funding allocation for natural resource protection efforts are often determined by existing prioritization or scheduling mechanisms, such as the EOEA Five Year Basin Cycle Schedule, EOEA Secretary of Environmental Affairs prioritization initiatives (Southeastern Massachusetts and Berkshire Regions), etc. In recognition of the range of prioritization and scheduling mechanisms operating at various scales, MRIP was modified to emphasize assistance of ongoing efforts, as opposed to directing efforts toward a process in which MRIP focus areas would be identified based upon consensual agreement.

The emphasis on "assistance" was represented in three general formats: (1) development of a decision support system tool articulating "select resource value"; (2) a resource co-occurrence analysis; (3) and engagement as well as promotion of "select resource value" discussions amongst professionals representing a multitude of natural resource categories (agriculture, forest, habitat, water, and cultural/recreational). Similar to the methodology applied in the

New Hampshire pilot project, efforts focused on analysis and communication of resource information captured in the following criterion list:

- **Resources that Co-occur**. Areas that have a variety of high value natural resources
- **Scarcity of Resource.** Areas that contain one or more resources that are very rare in the state, including areas of high biodiversity
- **Resources of State Significance.** Areas that provide the best example of a particular resource in that state.
- **Proximity of Resource to Threats.** (a.) Areas where natural resources are not in imminent danger. In this case, there is a better chance of protecting the area because it already has a healthy ecosystem (more emphasis on prevention rather the restoration). (b.) Areas where a natural resource is threatened. In this case, there is a need to focus protection measures in the area to address the immediate risks.

B. Focus and Goals

The project focus was defined as ***the identification of natural resource areas important to the quality of life and promotion of an ecosystem approach to natural resource management***. Project goals included:

Project Goals

- Identify areas in Massachusetts that contain significant natural resources.
- Highlight existing and potential threats to natural resource areas.
- Utilize an iterative approach in the designation of "resource concentration areas".
- Facilitate communication and promote cooperation among diverse organizations.
- Support partnerships, such as watershed teams, in their efforts to protect valuable resources through increased awareness and pro-active measures such as land acquisition.
- Provide information and input to the New England region-wide Resource Protection Project.

The principal process for achievement of goals involved interaction with resource professionals to garner feedback related to the identification of areas containing significant natural resources as well as existing and potential threats to the resources, and articulation of this information within a user friendly software product, the MRIP tool. The MRIP steering committee directed the resource concentration area analysis as an additional effort to identify areas of significant value, specifically geographic areas in which resource organization partnerships could effectively jointly prioritize protection efforts. MRIP products developed are being distributed to individuals/organizations directing efforts towards the protection of natural resources. In addition, the MRIP information will be merged with previously developed EPA Resource Protection Project information in an effort to identify the regional distribution of significant natural resources.

C. MRIP Coordinator and Steering Committee

Project coordinator responsibilities included steering committee coordination, facilitation among resource professionals representing various agencies and/or organizations, and product development and distribution. Tasks were accomplished with the assistance of MRIP team members Christian Jacqz (MassGIS, Director) and Myra Schwartz (EPA, Project Coordinator), as well as valuable input from interested individuals including, but not limited to, Leslie Luchonok (EOEA ACEC Program Director), Mike Almeda (EOEA Director of Land Policy), Steve McRae (EOEA DFWELE), and Bill Rivers (EOEA DEM) (*see section VI Acknowledgments for a full listing of individuals involved*).

The MRIP steering committee was composed of experienced resource professionals from throughout the Commonwealth (see *Section VI, Acknowledgments.*). The role of the steering committee was to guide the development of the project planning process, including modifications to the original RPP design, and to ensure project integrity. The MRIP Steering Committee convened four times in 1999, during which they reviewed and provided input related to the project design and assisted the resource concentration areas identification.

IV. MRIP Products

Three MRIP products developed include the "decision support system tool", the resource concentration area map, and a series of maps synthesizing information related to the selected resource categories (agricultural, forestry, habitat, water resources and a development map). The MRIP tool is an automated GIS product that depicts select resource value of several resource categories, defined by input from resource professionals, capable of systematically analyzing landscapes at user-defined scales. The resource concentration area map is one iteration representing select resources that co-occur within the Commonwealth, including the protection status of co-occurring resources. The MRIP resource maps represent a static picture of select value resources. They were developed in an effort to extend assistance to individuals/organizations not utilizing computer technologies.

A. MRIP Decision Support System Tool

The MRIP tool was developed based on the concepts of a land planning approach originated by Ian McHarg. Originally using mylar sheets as opposed to sophisticated GIS software programs, McHarg embraced the concept that areas throughout a landscape have varying degrees of value, as well as varying degrees of threat. McHarg's approach emphasized an understanding of the spatial location of select value areas and threats during the decision making process. The MRIP tool is simply an automated version of the McHarg approach.

Interactions with approximately 75 resource and planning professionals provided input defining the select value information contained within the tool. For example, foresters conveyed the importance of knowing the spatial location of forest resources (both structure and composition), managed forest lands, surface water protection areas, as well as information related to high fire hazard areas, and invasive species range information. If the desired information existed as a GIS data layer statewide or could easily be developed it was included within the MRIP tool. Data layers for which interest was expressed but for which development extended beyond the scope of this project, are listed in section IV-A2. The display and/or "arrangement" of the select value data within the tool are a reflection of input received from the professional community.

In summary, the MRIP tool provides a significant amount of information in a user-friendly format, selected for its importance by resource and planning professionals. The tool supports the decision or planning process by providing arguably the best examples of existing digital spatial data. As additional data become available or existing data are updated, they can be integrated into the MRIP tool. Unlike a static map, the design of the tool allows the user to define study area scale, as well as manipulate and add additional data to the tool views.

1. Resource Views

The MRIP tool contains seven "views," essentially automated maps, each related to a specific resource category, containing select resource information. The information contained within each view represents one iteration or display format. In essence, each view is a starting point for reviewing resource information. Users can manipulate the information contained within the view, add additional information to the view, or create new views. Whereas a map is limited to one static view of select information, the MRIP tool is dynamic in nature and provides the user with the ability to customize a map or view based upon his or her objectives.

Information contained within each resource view as well as a general description of the data is described in the following paragraphs. Detailed or "meta-data" documents are provided for each data layer within the MRIP tool by utilizing the "Describe" function.

a. Aquatic Habitat Resources

Anadromous Fish, Bathymetry, Marine Sanctuaries, and Eelgrass

Aquatic resources mapped include specific species (i.e. anadromous fish) as well as natural communities (i.e. eelgrass beds). The bathymetry data provide a generalized rendition of benthic zones serving as habitat for numerous aquatic species. Marine Sanctuaries, such as the Stellwagen Bank National Marine Sanctuary, depict areas for which increased awareness is promoted as the result of aquatic species or communities presence.

b. Agricultural and Marine Resources

Agriculture (cropland, pasture, and woody perennial), Chapter 61A properties, CR/APR properties, Fish Traps (1998), Lobster Harvest Zones (1997), Prime Farmland Soils (partial), and Designated Shellfish Growing areas.

A display of the MassGIS Land Use agricultural classes highlights the distribution and abundance of agriculture resources within Massachusetts. The Chapter 61A and CR/APR properties represent landowners active in stewardship related to the agricultural value of their land. A caveat related to the Chapter 61A data in particular is that collection of this information was not complete in effort or extent throughout the Commonwealth; many communities provided this information while others did not during the development of the MassGIS Protected and Recreational Open Space data layer (which contains the Chapter 61A information). However, reasoning supporting the inclusion of a data layer of limited completeness relates to the idea of working with what is known and in turn encouraging the fulfillment of data gaps. Prime Farmland Soils depict areas in which the soil properties best support agricultural activities. Prime Farmland Soils have only partially been developed to date, with development efforts ongoing. In the absence of this information cropland may serve as a surrogate for prime farmland soil. Fish Traps (Weirs) and Lobster Harvest Zones provide a general indication of productive areas or locations for the harvest of marine resources. Designated Shellfish Growing Areas depict areas of potential shellfish habitat.

c. Cultural/Recreational Resources

Long Distance Trails, Open Space by Ownership, Rail Trails, Scenic Landscapes, and State Registry of Historic Places

Long Distance and Rail Trails represent areas for which recreational opportunities exist. In addition they potentially represent connectivity within landscapes. For example, they are often identified as or a part of "greenways" providing connectivity throughout landscapes. Open Space parcels similarly may represent recreational opportunities, components of corridors or greenways (e.g. The North Quabbin Greenway, Boston's Emerald Necklace, etc.,), as well as cornerstones for additional land protection initiatives. Scenic Landscapes depict areas identified as part of the Massachusetts Landscape Inventory Project (Department of Environmental Management, 1981). The areas represent areas of significance or value related to agricultural, historic and scenic landscapes. The State Register of Historic Places (SRHP) data layers consist of both point and polygon coverages representing center point locations or boundaries of significant historic properties and sites with legal designations under several specific local, state and federal statutes. Historic resources in the SRHP data layer include buildings, structures, objects, sites, landscapes and districts.

d. Development (Threats)

Estimated Acres Developed (1980-1996), Land Use Change (1971-1985), Land Use Change (1985-91, Eastern MA.), Road Density (feet/acre)

The Estimated Acres of Development data layer was created for the Massachusetts Audubon report, "*Losing Ground II*". The data layer depicts development information from a predictive model created by consultants Phillip Herr and Associates. Estimated acres of commercial and residential development normalized by square mile for each community is displayed. As the name implies, the Land Use Change data layers depict changes on the landscape from one Land Use type (e.g. Forest) to another (e.g. Residential). Associated attribute codes provide information as for past as well as present Land Use codes. The Road Density data layer was created for the Massachusetts Audubon report, "*Losing Ground II*". The intended use of this information is to provide an indication of the level of fragmentation as represented by road development within Massachusetts communities.

e. Forestry Resources

Contiguous Natural Lands (250-499, 500-2000, greater than 2000 acres), GAP Forest, MRLC Forest, Open Space by Ownership (DEM, DFWELE, MDC, DFWELE/DEM, Chapter 61 forested lands), Open Space (Protected in Perpetuity), Surface Water Protection Areas.

Contiguous Natural Lands represent areas for which fragmentation effects are potentially less severe. Larger blocks of contiguous natural lands in highly fragmented landscapes are less likely to be affected by edge effects such as predation from opportunistic omnivores and invasion of exotic species, and may reduce isolation of habitats. In addition, fragmentation to silviculturalists is often defined by size of the ownership parcel with a direct correlation between forest stewardship activities and a parcels size (i.e. larger parcels – increase in forest management activity). In the absence of assessors' parcel data, contiguous natural lands may serve as a surrogate for the locations of larger parcels of land. The GAP Forest data is a selected set of landcover categories from the GAP Southern New England Vegetation Data

layer. The forest categories are displayed at an alliance level (e.g. Northern Hardwoods). MRLC Forest is a subset of landcover categories from the Multi Resolution Land Characterization (MRLC) National Land Cover Data layer (NLCD). The GAP and MRLC Forest data layers were developed to support small scale (e.g. 1:250,000) planning efforts and may not be suitable for large-scale applications. Open Space by Ownership depicts lands owned by three EOEA divisions as well as Chapter61 forest lands. The display of this information represents a subset of the MassGIS Protected and Recreational Open Space data layer. These four ownership categories arguably depict owners of the greatest amount of forest in Massachusetts, as well as most active in terms of forest management. It should be noted that many Chapter61 forest land properties are not contained within this dataset (see note: Section IV, A, 1a, Agriculture Resources, Chapter61A). The display of Open Space lands protected in perpetuity (i.e. permanently protected) is designed to highlight those areas. A display of all protected and recreational open space information (varying levels of protection) can be added to the view. Surface Water Protection Zones are areas in which land management, including forest management activities become increasingly important for maintenance of ecosystem integrity.

f. Habitat Resources

ACECs, Contiguous Natural Lands (500-2000, greater than 2000 acres), Ecoregions, Natural Lands (MassGIS Land Use, MacConnell), Lakes/Ponds/Wetlands, Rivers & Streams, NHESP Priority Habitats/Wetland Habitats/Certified Vernal Pools (1997-1998), Natural Lands Riparian Corridors, Riparian Corridors, MRLC Forest, Species Density (NHESP), Open Space (protected in perpetuity).

The Areas of Critical Environmental Concern (ACEC) data layer shows the locations of areas that have been designated as ACECs by the Secretary of Environmental Affairs. ACEC designation requires greater environmental review of certain kinds of proposed development under state jurisdiction within ACEC boundaries. The value of contiguous natural lands was articulated in the previous paragraph. The selection of contiguous natural lands area values (e.g. 500-2000 acres) relates to potential minimal habitat requirements for select migratory birds. The 500-acre value should be considered a potential starting point in efforts to identify significant large patches of contiguous natural lands within the context of an adaptive management approach. The geometric shape varies amongst the "patches" and should be noted (i.e. edge effects may be more significant within elongated patches as opposed to round patches). Ecoregions are landscape units within which environmental conditions are similar. In efforts to represent all elements of biodiversity, it is beneficial to identify species and habitat types occurring within specific ecoregions. Natural lands as defined to meet the objectives of the project are a selected subset of Land Use information, allowing the viewer to focus on areas for which greater habitat protection opportunities may potentially exist. Lakes, ponds, rivers, streams and wetlands represent various types of habitat, as well as processes or flow regimes. The Priority Sites of Rare Species Habitats & Exemplary Natural Communities polygons represent estimations of the most important natural communities and state-listed rare species habitats in Massachusetts. Estimated Habitats of Rare Wildlife polygons represent estimations of the resource area habitats (defined within the Wetland Protection Act regulations) of state-listed rare wildlife populations. The Vernal Pools data layer contains points of all vernal pools which have been certified by the Natural Heritage & Endangered Species Program (NHESP) according to the Guidelines for Certification of Vernal Pool Habitat (5/88, MA Division of Fisheries

and Wildlife). Riparian Corridors are defined as 100-meter corridors encompassing perennial stream and river features as coded within the MassGIS 1:25,000 hydrography data layer. The Natural Lands Riparian Corridors data layer depicts areas within the riparian corridor that remain in a "natural state", potentially functioning as a corridor for select species movement, as well as additional ecological purposes. It is important to note the "natural land" definition and the distance defining the riparian corridor were tailored to meet the objectives of the Massachusetts Resource Identification Project (MRIP). MRLC Forest depicts select classes of the MRLC NLCD, highlighting potential habitat protection opportunities. The Species Density data layer was created for the Massachusetts Audubon report, "*Losing Ground II*". The intended use of this information is to provide a general display of rare, threatened, and special concern species density within Massachusetts communities. The display of Open Space parcels protected in perpetuity (i.e. permanently protected) is designed to highlight those areas, serving as a potential "gap" analysis.

g. Water Resources

Aquifers (med./high yield), Interim Wellhead Protection Areas, Surface Water Protection Areas (zones a, b, c), Outstanding Resource Waters, Lakes/Ponds/Wetlands, Rivers & Streams, Water Supplies, Sole Source Aquifers, ZoneII Wellhead Protection Areas, Open Space (protected in perpetuity).

The Water Resources View does not contain data layers that were not previously part of the MassGIS data library. However, the view has organized them for ease of display and provides an overlay of Open Space parcels protected in perpetuity. A general description of each data layer is provided below; utilize the tool's "Describe" function for a detailed description.

The Aquifers data layer graphically depicts information collected and published by the USGS-WRD. The definitions (e.g. high/medium) vary amongst watersheds. The Mass. Department of Environmental Protection and MassGIS maintain the data layer. A ZoneII Wellhead Protection Area is "that area of an aquifer which contributes water to a well under the most severe pumping and recharge conditions that can be realistically anticipated (180 days of pumping at safe yield, with no recharge from precipitation). It is bounded by the groundwater divides that result from pumping the well and by the contact of the aquifer with less permeable materials such as till or bedrock. In some cases, streams or lakes may act as recharge boundaries. In all cases, ZoneIIs shall extend up gradient to its point of intersection with prevailing hydrogeologic boundaries (a groundwater flow divide, a contact with till or bedrock, or a recharge boundary). In the absence of a DEP approved ZoneII for any well, DEP has adopted the Interim Wellhead Protection Area. Surface Water Supply Protection Areas delineate those areas included in 310 CMR 22.00, the Massachusetts Drinking Water Regulations. Surface Water Protection Zones are areas in which land management, including forest management activities become increasingly important for maintenance of ecosystem integrity. The Outstanding Resource Waters data layer delineates those areas afforded *Outstanding Resource Waters* classification under the Massachusetts Surface Water Quality Standards of 1995. These waters constitute an outstanding resource as determined by their outstanding socioeconomic, recreational, ecological and/or aesthetic values. The Public Water Supplies data layer contains approximately 1784 public community water supplies, as defined in 310 CMR 22.00, and 1478 public non-community sources. A Sole Source Aquifer (SSA) is an aquifer designated by US EPA as the 'sole or principal

source' of drinking water for a given aquifer service area; that is, an aquifer which is needed to supply 50% or more of the drinking water for that area and for which there are no reasonably available alternative sources should that aquifer become contaminated. The display of Open Space lands protected in perpetuity (i.e. permanently protected) is designed to highlight those areas.

2. Planned Data Updates

As previously described the MRIP tool provides spatial data for assistance with planning decisions. While the tool contains a significant amount of information, it would benefit from the inclusion of additional information sources. The information listed below captures much of what was conveyed as desirable additions to the MRIP tool.

a. Updated Land Use : For much of the state 1985 is the most current information available. This information is currently being updated for the entire state and is projected to be completed by July of 2001.
b. Statewide Soils : This information could support numerous ongoing planning initiatives including build-out analysis, cropland assessments, etc. The information is being developed by NRCS and EOEA jointly, with funding from EOEA and over 80% of the state will be completed by July of 2001.
c. Statewide Parcel Data
d. Updated Open Space : Especially, the inclusion of additional Chapter61 information as well as updates to existing information.
e. Natural Communities: Referring to identifiable groups of organisms and their physical environments, distinguished by their biota, abiotic characteristics, or some combination of the two. The Natural Heritage program in the Department of Fisheries, Wildlife and Environmental Law Enforcement is developing a "bio-map" for the state in state FY01.
f. High Fire Hazard Areas (pitch pine / scrub oak areas in proximity to development)
g. Prime Forest Land Mapping: Information developed at the University of Massachusetts. A conversion of the existing paper format information or development of current digital data is desirable.
h. Environmental Sensitivity Index Data (ESI): Information recently completed as a component of a NOAA/HazMat project.
i. 301B & 303D: Water quality information

B. Resource Co-occurrence

"All things being equal, co-occurrence of significant natural resources is of greater value than single occurrence". This adage has been the basis of numerous prioritization efforts, including academic exercises, community open space plans, and the prioritization of Resource Protection Areas as part of the Rhode Island Resource Protection Project. Analysis of co-occurrence is often described as an objective approach for the identification of priority or focus areas. A caveat relating to the objectives defining the focus areas.

Reality dictates that "not all things are equal," therefore solely using a natural resource co-occurrence analysis to objectively define the "most significant", "best examples of", or "healthiest" ecosystems/natural resource areas within a region lacks merit. However, having knowledge of the distribution and/or abundance of areas in which multiple significant

natural resources co-occur can be an integral layer of information assisting resource protection efforts. For example, the Executive Office of Environmental Affairs Inter Agency Lands Committee (EOEA ILC) has as an objective the establishment of division partnerships (DEM, DFWELE, MDC, etc.) in efforts to prioritize land for acquisition so as to maximize resource protection efforts in light of limited resources. The identification of resource co-occurrence areas to assist these efforts illustrates a potential use of the MRIP resource co-occurrence component.

The MRIP Steering Committee discussed at length the co-occurrence analysis process, evaluating the merits and limitations associated with information developed from this exercise. In selecting the resources for analysis of co-occurrence, the steering committee was presented a list of potential resources, specifically resources contained within the MRIP tool (see section IV). A group consensus was reached in which the following resources were included in the co-occurrence analysis:

1) Estimated Habitats of Rare Wildlife
2) Priority Sites of Rare Species Habitats & Exemplary Natural Communities
3) Outstanding Resource Waters
4) Medium & High Yield Aquifers
5) Natural Lands (lu21_code: 2,3,4,6,14,20,21)
   - representing undeveloped lands or lands for which protection opportunities are arguably greatest
6) Contiguous Natural Lands greater than 500 Acres.
   - potentially representing viable habitat for numerous species in decline (e.g.. migratory birds), as well as keystone species.
7) MassGIS Open Space (protected in perpetuity)

The Arc/Info Grid module was used to create a data layer representing co-occurrence. Applying a continuum of color ranges representing the co-occurrence values 1-6 a map, "Resource Concentration Areas", was produced displaying the areas of co-occurrence. Following an initial review of this information, the steering committee decided an effective display of this information would include the MassGIS Open Space protected in perpetuity information. A display of the permanently protected lands in Massachusetts overlay on the co-occurrence information highlights unprotected areas in which opportunities may exist related to the protection of multiple resources.

C. MRIP Resource Maps

Display of all information contained within each MRIP tool view on a hard-copy map is not feasible. Design issues, such as the 1:265,000 scale, limit what can legibly be displayed. As a result, only selected information depicting select resource value is displayed within each map layout. As noted previously, an advantage of the use of the MRIP tool as opposed to a static map is user preference control, specifically the ability to define scale and thematic display. However, paper maps are a preferred media to many for working documents and extend MRIP information to non-computer users. Original map copies exist in a 1:265,000 scale, within a 36 x 28-inch layout. Copies of select resource maps are contained at the end of this document. However, as a result of the 11 x 8.5-inch layout limitations, legibility is limited.

The intent in including them is simply to provide examples of the large format maps. Copies of the large format maps will initially be available through MassGIS.

1. Select Agricultural Resources

The Select Agricultural Resources map depicts three types of agriculture contained within the MassGIS Land Use data layer (MacConnell) cropland, pasture, and woody perennial. Prime Farmland Soil, and APR & CAPR parcels as well as Chapter 61A are displayed as well.

2. Development (Land Use Change)

Representations of development depicted on this map include: Land Use change 1971-85 (statewide) and Land Use change 1985-1991 (Eastern Mass.).

3. Select Forest Resources

The Select Forest Resources map depicts Contiguous Natural Lands (250-499, 500-2000, and greater than. 2000 acres), Surface Water Protection Zones (zones A, B, C), and selected Protected and Conservation Lands (Chapter 61(forest), DEM, DEM/DFWELE, DFWELE, MDC).

4. Select Habitat Resources

Select habitat resources depicted on this map include: Contiguous Natural Lands (500-1999 acres, and greater than. 2000 acres), Mass. Heritage Program Data (Priority Habitats for State Listed Rare Species, Estimated Habitats for Rare Wildlife, Certified Vernal Pools, and Exemplary Natural Communities), and Areas of Critical Environmental Concern (ACECs).

5. Select Water Resources

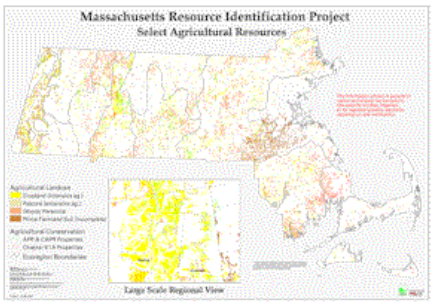
Mapped features include: Outstanding Resource Waters (public water supply contribution and other ORW), Aquifers (sole source, medium and high yield), Zone IIs, Interim Wellhead Protection Areas (IWPA), and Surface Water Protection Areas (zone A, B, C).

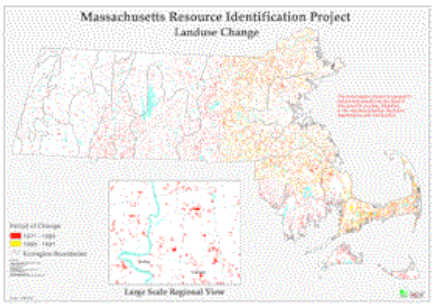
6. Resource Concentration Areas

This map depicts areas of resource co-occurrence. Resources included within the co-occurrence analysis include Estimated Habitats of Rare Wildlife, Priority Sites of Rare Species Habitats & Exemplary Natural Communities, Outstanding Resource Waters, Medium & High Yield Aquifers, Natural Lands (lu21_code: 2,3,4,6,14,20,21), and Contiguous Natural Lands greater than 500 Acres. MassGIS Open Space (protected in perpetuity) is displayed as well.

(See examples of maps on next page. Full-page maps appear at the end of this document.)

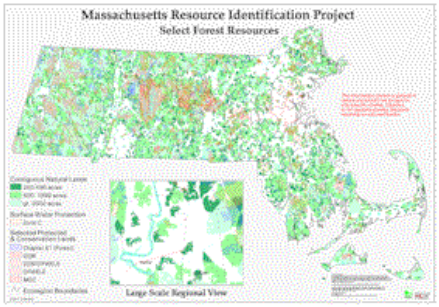
Select Agricultural Resources

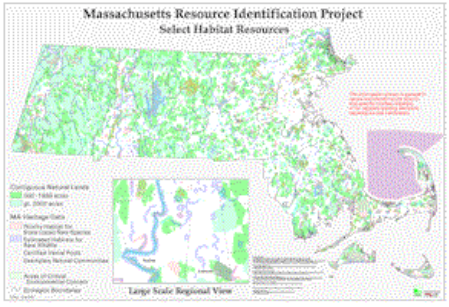




Development (Land Use Change)

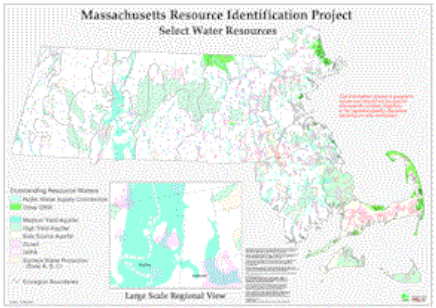
Select Forest Resources

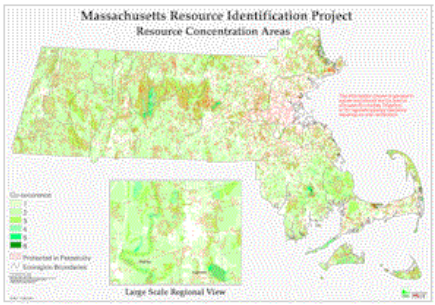




Select Habitat Resources

Select Water Resources





Resource Concentration Areas

D. Product Availability

The MassGIS Data Viewer, including the MRIP tool component, is distributed upon request from the MassGIS Web Site (**http://www.state.ma.us/mgis/mrip.htm)**. The series of "select value" maps as well as the Resource Concentration Areas map, in a hardcopy (paper) format, have been distributed to select individuals including but not limited to the MRIP Steering Committee members. Additional copies are available upon request as well as in an electronic format provided as a download from the Web page.

V. Acknowledgments

Participation for this project varied significantly in degree. There were numerous individuals intricately involved, providing valuable guidance and insight related to project guidance and product development. There were those able to provide brief but useful and encouraging feedback, as well as individuals relating concerns about the potential misuse of project-developed information and opting to respectively not be involved. All individuals contacted demonstrated a great amount of professionalism regardless of their viewpoints and are thanked for their efforts. Individuals donating a significant amount of time in light of engaged schedules and providing invaluable feedback and input receive special thanks. Coordination of the project would have been a challenging task in the absence of their involvement. All individuals providing input or feedback at one level or another are noted below, organized by resource category.

A. MRIP Steering Committee

EOEA: Mike Almada (Land Policy), Rob Deblinger (Dept. of Fish & Wildlife), Rick Dunn (DEP), Christian Jacqz (MassGIS), Rich Hubbard (Dept. Food and Ag.), Leslie Luchonok (ACEC Program), Steve McRae (DFWELE), Bob O'Connor (Watershed Initiative), Bill Rivers (DEM), Dave Szczeback (Heritage Program), Maria Van Dusen (Riverways Program); EPA: Myra Schwartz

B. Agricultural Resource

Rick Devergileo, Sean Fein, and Bill Taylor (NRCS), Jerry Cosgrove (American Farmland Trust), Rich Hubbard and Barbara Hopson (EOEA Dept. Food and Ag.).

C. Forestry Resource

Keith Ross (New England Forestry Foundataion), David Kitteredge (UMASS), David Foster, John O'Keefe, Glenn Motzkin, Ruth Kern, David Orwig, Jim Parshall, Donna Francis, Audrey Barker-Plotkin, Ben Slater, Matt Kizlinkski, Susan Clayden, Elaine Doughty, and Rob Eberhardt (Harvard Forest), Rachel Rieman-Hershey (USFS), Warren Archey, John Scanlon, Jim Soper, Charlie Berman, Alison Wright (DEM)

D. Habitat Resource

Mark Anderson, Frank Biasi, Greg Kehm (The Nature Conservancy), Vin Anthill, Russ Hopping, and Lisa Vernagaard (Trustees of Reservation), Jack Finn, David Goodwin, Scott Jackson, and Curt Griffin (University of Massachusetts), Tom Rawinski and Jennifer Steele (Mass. Audubon Society), Jim McDougal (Essex County Greenbelt Association), Steve Lehmann and Jill Peterson (NOAA/Hazmat), Dave Publicover (AMC), John Scanlon, Mark Tisa, Henry Woolsey, Jim Fair, Tom Hoopes, Russ Cohen, (DFWELE), Bob Haynes (DEP), Chris Chisholm (DEM)

E. Water Resource

Mark Smith, Christine Armstrong, Michele Coban Barden (Neponset River Watershed Watershed Association), Mindy Roberts (Charels River Watershed As.), Sally Soule and Adam Futterman (Nashua River Watershed As.), Ralph Goodno (Merrimack River Watershed Council), Joanne Carr (Nashua EOEA Watershed Team leader), Mary Crane-

Penniman, Frances Clark, Carol Gumbart, Ken Curry, Dave Burke, Carl Melberg (Suasco Habitat Task Force), Christine Armstrong (EOEA Watershed Initiative)

F. Cultural / Recreational Resources and Development

Nathanael Lloyd and Melanie Marie Brown(DEM), Larry Garland (AMC), Liz Sorenson (ACEC), John Lipman (EOEA),

G. Project Technical Assistance

MassGIS Staff, Aleda Freeman, Shari Heier, and Michael Trust in particular, provided countless hours of technical support and served an integral role in the completion of the project.

VI. Conclusion

An effort that includes a heightening of awareness or highlighting of value related to specific resources or resource areas often is quite controversial in nature. Systematically applying a methodology selecting areas of importance or focus areas at a set scale, by a select group of individuals, based upon broad or loosely defined objectives is inherently subjective. This notion was expressed by many during the development of the MRIP project and raised genuine concerns relating to the potential use or misuse of this information. MRIP project staff openly discussed these concerns with the project steering committee as well as with others and have addressed them as well as they could by placing the emphasis of the MRIP effort towards assistance with ongoing efforts, specifically providing information products (MRIP tool and maps).

To avoid misuse of MRIP products, a significant amount of time was devoted to the creation of caveats related to specific sources of information. In addition, a general project caveat is that the MRIP project staff openly encourage the use of MRIP project products, while emphasizing the concept that MRIP information simply represents another layer of information assisting resource-planning efforts. The information should not be placed in a hierarchical framework of importance but should be considered or reviewed as one would with any form of available information.

Numerous individuals and/or organizations have communicated the need for additional information to assist planning efforts. Many are allocating resources towards the manipulation of existing information, challenged by the complexities related to using sophisticated software and complex databases. An immediate benefit with the completion of MRIP is that organizations and/or individuals will be able to review MRIP products and prioritize resources towards filling the information gaps. The Data Viewer including the MRIP component provides the vast majority of existing digital data layers. Users will be afforded the opportunity to forego devoting time to receiving and manipulating existing data layers, and will be able to increase efficiency related to creating additional data instead. For those who have demonstrated a willingness to proactively assemble and theoretically conceptualize optimum ways in which to sustain and manage landscapes, the MRIP tool can serve as an application vehicle assisting such efforts.

Next steps or remaining tasks related to MRIP include distribution of the report, tool, and map products as well as the provision of technical support. Numerous individuals await completion of this effort, desiring to utilize the MRIP products to support ongoing planning initiatives. Outreach goals include the provision of report and map products accessible from the MassGIS Web Site (**http://www.state.ma.us/mgis/mrip.htm)** and CD-distribution of the tool.

For the EPA, MRIP completes the EPA Resource Protection Project within the New England states. Information developed can be merged with information from the other projects, making it possible to understand the regional patterns and distribution of healthy ecosystems and important natural resources. In turn, this will assist in determining places where effective pollution prevention and resource protection strategies can be implemented.